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PATENT SPECIFICATION

Application Date: March 31, 1922. No. 9317/22. **203,010**

Complete Accepted: Aug. 31, 1923.

COMPLETE SPECIFICATION.

Improvements in Shock Absorbing and Coupling Devices.

I, IRVIN HUPP, of 332, South Michigan Avenue, in the City of Chicago, County of Cook and State of Illinois, United States of America, Engineer, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention has for its object means whereby aligned shafts or shaft sections may be flexibly connected together so as to transmit the power or rotative force in a yielding manner from the one shaft or section to the other shaft or section.

The invention relates to coupling and shock absorbing devices of this kind which include a toothed or cam-shaped member connected to the driving element and adapted to co-operate with one or more spring controlled cam-shaped members in such a manner as to first exert compression on the spring to transmit indirect motion from one element to the other and after a predetermined and positively limited indirect movement to then transmit said motion direct.

The present invention primarily consists in a device of this type having a pair of opposingly arranged members adapted to be secured to the ends of two aligned shafts, spring controlled means provided with a toothed or cam surface disposed between said members and arranged to have interlocking relation with a similar toothed surface on one of the first mentioned members and an abutting relation with the other member (on which it is slidably keyed) so that its range of movement is limited to an amount insufficient to permit of complete separation of the toothed or cam surfaces.

The invention also consists in the modified form of construction hereinafter described and having duplicated toothed or cam-engaging devices.

The invention further consists in a device of this character having a shell or housing disposed about all the members of the coupling for containing lubricant whereby all movable members may be immersed in oil. It also comprises a device of this character constructed as a connected and complete self-contained unit adapted to be attached between aligned shafts having spiders or flanges at their ends.

In the accompanying drawings,

Figure 1 is a side elevation of one form of my invention, with a portion of the outer casing or shell shown in section.

Figure 2 is a longitudinal sectional view of the construction shown in Figure 1.

Figure 3 is a cross sectional view taken on the line 3—3 of Figure 1.

Figure 4 is a detail perspective view of one of the clutch or toothed members of the coupling means.

Figure 5 is a longitudinal sectional view of a modified form of my invention.

Figure 6 is a detail view in perspective of one of the clutch or toothed members employed in the modified form shown in Figure 5.

My improved coupling means, as illustrated, is especially intended for flexibly coupling aligned flanged shafts and more particularly for use in automobiles to flexibly couple driven shaft sections, as for example in the driven shaft at a point intermediate of the transmission and differential mechanism, where its function would be to compensate, or absorb the impacts or shocks resulting during operation of the automobile; namely the violence of fluctuation of the power impulses encountered when the transmission mechanism is actuated to transmit power to the driven shaft leading to the differential mechanism or the initial power impulses of the motor. The invention, as set forth in the particular exemplification illustrated in the first four figures of the drawings, comprises a member 10 which is shown preferably flanged at 11 to permit the member to be attached to a

[*Price* 1/-]

similar flange or collar secured to the adjacent end of a shaft or shaft section. The member 10 is provided with circumferentially disposed teeth or cam projections 12 disposed in a direction lengthwise of the coupling means; the teeth or projections being provided with gradually sloping or spirally curved faces 13 on one of the surfaces thereof, while the other surface of each tooth or projection 12 is disposed parallel with the longitudinal axis of the device as shown at 14 in Figure 1, thus providing a flat engaging or clutching surface whereby any rotative movement in a direction toward said surface 14 will cause an interlocking relation between the member 10 and a complementary or correlated member 15 which is splined or slidably keyed on a short shaft 16 arranged intermediate of the ends of the coupling means, see Figure 2, and rotatable relatively to member 10. The member 15, like member 10, is likewise provided with a number of complemental circumferential engaging projections or teeth 17 which are disposed in a direction lengthwise of the coupling means and one surface of each tooth or projection is made sloping or spirally curved as at 18 (see Figure 4) to correspond with and receive the sloping face 13 of the projections or teeth 12 of the member 10 (see Figure 1). The teeth or projections 17, like the teeth or projections 12, terminate abruptly so as to provide the straight or interlocking surfaces 19 adapted to form and have abutting relation with the surfaces 14 of the teeth or projections 12 of member 10. In the particular exemplification, both members 10 and 15 are each shown provided with three teeth or projections of complementary configuration and of considerable depth to permit a yielding relation to exist between the members 10 and 15 before the hub portion 15^1 of one member 15 has been brought into abutting relation with the hub 15^1 of a second and similar member 15 arranged at the opposite end of the short shaft 16 and at the same time maintain a partial overlapping relation between the sloping surfaces of the cam projections or teeth of the adjacent members. The two members 15 are yieldingly maintained in spaced relation by a suitable coil-spring 20 disposed about the hubs 15^1 of both members 15, with the ends of the spring bearing against the main or body portions of both members 15 as clearly shown in Figures 1 and 2, thereby maintaining the two members 15 in meshing relation with the members 10 and 21 arranged at opposite ends of the coupling means.

The opposite end of the coupling means as illustrated in Figures 1 and 2 is provided with a member 21, substantially similar to member 10 and secured to the end of a shaft section 22 so as to rotate therewith; member 21 being provided with circumferentially disposed teeth or projections 23 disposed in a direction lengthwise and toward the opposite end of the coupling means and having sloping or slightly curved surfaces 18 and abrupt flat surfaces 19 similar to the surfaces 13 and 14 of member 10; the teeth of member 21 being adapted to have sliding or yielding relation with the teeth or projections of the adjacent member 15 when force is applied in one direction, or an interlocking relation with the teeth or projections of the adjacent member 15 when rotative force is applied in the opposite direction.

It is apparent from the construction shown and described that when rotative force is applied to member 10 in clockwise direction, a positive or interlocking relation with the adjacent member 15 is effected and, by reason of the two members 15 being splined on the short shaft 16, rotative movement in a similar direction will also be given to the member 15 at the opposite end of the coupling means. With the rotative force, however, being in clockwise direction as previously stated, it is evident that member 15, at the end of the means adjacent to shaft 22, will be caused to yieldingly transmit such power to member 21 on shaft 22 because the sloping or curved faces of the teeth or projections on member 21 and adjacent member 15 (which is slidably mounted) are then caused to be brought into operative or power applying relation; in other words the flat interlocking surfaces of said member 21 and adjacent member 15 will be caused to move away from each other, and a yielding operative relation between member 21 and adjacent member 15, commensurate with the resiliency of spring 20, is produced. If the force or power applied to the short shaft 16 through the medium of member 10 and adjacent member 15 is greater than the tension or resistance of spring 20, then the member 15 adjacent to member 21 will be caused to ride up on the sloping or curved surfaces of the teeth 23 of member 21 until the inertia of the shaft 22 has been overcome.

As shown in the drawings, the hubs 15^1 of the two members 15 are of such length as to normally provide a gap therebetween which, however, is of a distance or length less than the length of the projections or teeth of the respective members, so that the teeth or projections

23 of member 21 will still be in contact with the curved or sloping surfaces of the teeth of adjacent member 15, at a point somewhat adjacent to the tips or ends thereof, so that slippage of the teeth of one member past the teeth of the adjacent member will be impossible; it being understood that the same is true with the teeth 12 of member 10 and adjacent member 15 when the power is applied in reverse direction. When the hub portions 15[1] of both members 15 are in abutting relation as described, a substantially positive operative connection between the coupled shafts will be provided because further separating movement of either member 15 is impossible, while the respective teeth will be in position as described; the spring 20, however, being of such strength as to resist all normal or usual impacts encountered by either members 10 or 21, so that an abutting relation between the hub portions of the two members 15 will be prevented except under abnormal conditions.

The member 21 is shown formed integral with the shaft section 22 and in abutting relation with suitable bearing metal in the nature of a disc or washer 24, see Figure 2. The disc 24 is preferably provided with oil passages or openings 25 arranged circumferentially at predetermined distances apart. The coupler as shown in Figures 1 and 2 is provided with an outer shell or tubular casing 26 having internally threaded ends, one of which is adapted to screw onto a threaded portion of member 10, as shown at 27, while the opposite end of the casing receives a threaded disc or closure member 28 thus connecting the member or disc 28 to the member 10. The tubular casing or member 26 is preferably held against accidental rotation on member 10 by a suitable set-screw 29, while the closure member 28 may be held against accidental unscrewing by means of a suitable set-screw 30. The shell or casing 26 at a suitable point is provided with an oil-introducing aperture which is closed by a suitable cap or bolt 31, see Figure 2. In practice, the shell or casing is filled with a proper lubricant so that all movable parts therein will be immersed in oil. In order that the lubricant may find passage intermediate of the respective moving parts of the coupling, the body portion of both members 15 is provided with oil passages or ports 32, 32, see Figure 2, which communicate with small grooves or sockets formed in the abutting portions or surfaces of the members 10 and 21, respectively.

As previously stated, if the force or power is being transmitted from member 10 to member 21, namely with member 10 rotating in clockwise direction, an interlocking relation will be provided between the projections or teeth 12 and 17 of member 10 and adjacent member 15, while a yielding relation will be provided intermediate of the projections or teeth of the other member 15 and member 21 at the opposite end of the coupling means, due to the fact that the rotative movement in clockwise direction, at the end of the coupling mechanism provided with or secured to the shaft section 22, causes the force or power to be transmitted by the sloping surfaces of the projections or teeth at this end of the coupler. If reverse operation of the driving shaft section secured to member 10 is provided, then an interlocking relation will be obtained between the teeth of member 21 and adjacent member 15, while a yielding relation between member 10 and its adjacent member 15 will be obtained; both members 15 being caused to rotate together because said members are slidably keyed on the shaft section 16 as indicated at 33 in Figure 3; and if the resistance or pressure is greater than the resistance or strength of the spring 20, then the two members 15 will be brought into abutting relation.

In Figures 5 and 6 I illustrate a modified form of my invention wherein a short shaft 34 is provided, terminating at one end in an enlargement or hub portion 35 which in turn is flanged as at 36 to permit the shaft section 34 to be secured to one of the driven shafts or members.

The hub portion 35 provides a suitable seat and bearing for the end of a coil spring 37, whose opposite end bears against the main or body portion of a member 38 which is provided with two or more projections or teeth 39 of the peculiar formation more clearly shown in Figure 6, namely with both surfaces of the teeth 39 made sloping as at 40 to opposite sides of the more or less flat crown portion and at the same degree of angle. The teeth or projections 39 are spaced sufficiently apart to receive therebetween the complementary projections or teeth 50 of corresponding formation and formed integral with a member 41, which is shown provided with a flange 42 whereby said member 41 may be attached to the adjacent end of a second shaft section. The member 41 is free to rotate on the end of the spindle or short shaft section 34 and proper relation between the various elements is maintained by means of a washer or disc 43 disposed

about the end of the spindle or shaft section 34 and within a countersunk portion or annular socket formed in member 41; while the end of the spindle or shaft 34 is shown threaded and provided with a nut 44 which may be held against accidental rotation by means of a cotter or other suitable pin as at 45 disposed through the end of the spindle or shaft 34 and seated within radial grooves 46 formed in the nut 44.

The spindle or shaft 34 is grooved longitudinally as shown at 47 to receive suitable keys on member 38 as at 48 whereby said member 38 is slidably secured to the spindle or shaft and caused to rotate therewith and at the same time permit member 38 to move lengthwise of shaft 34. The member 38 is provided with an elongated hub 49 of predetermined length and disposed toward the hub formation 35 of spindle or shaft 34, while normally providing a gap between hubs 49 and 35. The gap between hub portion 35 of spindle 34 and hub 49 of member 38 is of a length somewhat less than the length of the projections or teeth 39 of member 38 and the teeth 50 of member 41, in order that the hubs 35 and 49 may come into abutting relation and thus prevent the teeth 39 from passing or slipping over the teeth 50 of member 41 when member 38 is caused to move away from member 41 by reason of rotative power or force in excess of the resistance of spring 37.

The member 38 is shown provided with oil passages 51 whereby the oil or lubricant may find its way from the spring side of member 38 to the teeth or projection side of member 38 and cause a sufficient lubrication of the surfaces of the teeth of both members 38 and 41. In this construction, the respective elements are enclosed in a tubular shell or casing 52, disposed intermediate of and in close contact with the flanges 36 and 42, which provides an oil receiving chamber.

With this construction, if power is transmitted through the medium of member 41, it is evident that the power or force will be yieldingly transmitted through member 38 to the spindle or shaft 34 which in turn transmits the rotative force to the second shaft or member to which it is attached, causing the latter to be rotated in similar direction with member 41; the impulse or inertia, however, being compensated for by the spring 37. Should the resistance offered by the shaft or shaft section to which member 34 is secured be greater than the tension or resistance of spring 37, in that event member 38 will slide lengthwise of shaft or spindle 34 and the hub 49 of member 38 caused to come into abutting relation with the hub 35 of spindle 34 and thereby substantially provide direct connection between member 41 and member 34, because the tips of the teeth 39 of member 38 will still be in partial lapping or interlocking relation with the tips of the teeth 50 of member 41. By reason of the similar formation of the teeth of both members 38 and 41, namely with the double sloping surfaces to opposite sides of the apices or crowns of the teeth, reverse operation of either shaft to which the coupler is attached will likewise be yieldingly taken up or positively transmitted.

In both constructions the yielding action of the coupling means is obtained through the medium of compression springs 20 or 37; in other words, the spring or springs are merely subjected to a compression strain or action; and in both constructions the relation between the respective elements is such that the hubs 15^1 of members 15, or the hub 49 of member 38 and hub 35 of spindle 34 will be in abutting relation before a complete "seating" of the springs can result; so that the springs at no time will be subjected to any undue strains or actions, with the result that crystallization of the springs will be prevented.

With the constructions shown and described, the impacts or impulses encountered by either shaft at opposite ends of the coupling means will be absorbed and such impulses or rotative force yieldingly transmitted from one shaft to the other through the coupling means wherein the toothed members are of such diameter that teeth or projections of substantial length may be obtained and the teeth or projections formed to present the spirally disposed engaging surfaces disclosed in the drawings, which induce the comparatively easy outwardly wedging and easy inwardly seating or dove-tailing action of the impulse absorbing means.

I am aware of the Patent to Varley and another No. 2324 of 1873, and I make no claim to anything contained in the specification thereof.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a shock absorbing and coupling device of the type hereinbefore specified, a pair of opposingly arranged members adapted to be secured to the ends of two aligned shafts, spring-controlled means having a limited range of travel longitudinally between said members and pro-

vided with a toothed or cam surface adapted to have interlocking relation with a similar toothed surface on one of the first mentioned members and adapted to have abutting relation with the other member on which it is slidably keyed, its range of travel being less than that necessary to permit the toothed or cam surfaces to pass wholly out of engagement.

2. In a shock absorbing and coupling device of the type hereinbefore specified, a member adapted to be secured to a drive shaft, a second member adapted to be secured to a driven shaft, one of said members having a spindle or shaft extension disposed between both members, spring-controlled means slidably keyed to said spindle or shaft extension and normally spaced from an abutting portion thereon, said spring controlled means and the other of said members being provided with interlocking toothed portions whereby a yielding operative relation is provided between them and a positive driving relation effected when the torque of either shaft exceeds a predetermined degree and said abutting portions are brought into engaging relation.

3. A shock absorbing and coupling device according to Claim 1 or 2 having the toothed member secured to the end of one of the pair of aligned shafts to rotate therewith, a flanged shaft section, or spindle, disposed between both shafts and adapted to be secured to the other shaft of said pair to rotate therewith, a second toothed member slidably keyed on said flanged section and normally meshing with the first member and in predetermined spaced relation with the flanged end of said shaft section or spindle, a spring between the second toothed member and the flanged end of the shaft section to maintain the toothed members in contact, and means for limiting the range of movement of the second toothed member towards the flange of the shaft section, so as to preserve the interlocking relationship of the toothed members.

4. A shock absorbing and coupling device according to Claim 1 or 2 in which one member is provided with a spirally toothed surface while the other member is provided with the shaft section or spindle whereby the aligned relation between the two members is maintained, means slidable on and rotatable with said shaft section or spindle and disposed between both members, one end of said means being provided with a toothed surface interengaging with the toothed surface of the first member while the opposite end is provided with a surface correlated to the opposing surface of the second member whereby further sliding movement of said means is prevented and partial interengagement of the toothed surfaces maintained, and a coil spring disposed about said shaft section or spindle whereby said means is normally held in contactual relation with the first member.

5. A modification of the shock absorbing and coupling device according to Claim 1, in which the opposingly arranged members are each provided with toothed or cam surfaces with which co-operate other toothed or cam surfaces on further spring controlled members, having hub extensions on opposing sides to limit their sliding movement, the co-operating cam surfaces having sliding relation while the hub extensions provide positive relation between all the members when the last mentioned members have moved toward each other, the co-operating cam surfaces at one end of the device permitting sliding movement on each other when the twist is in one direction, while those at the other end provide interlocking positive relation and *vice versa*.

6. A shock absorbing and coupling device according to any of the preceding claims having a shell or housing disposed about all of the members of the coupling for containing lubricant whereby all movable members may be immersed in oil.

7. A shock absorbing and coupling device according to Claim 6 in which certain of the members are provided with means for passage of lubricant between said members.

8. A shock absorbing and coupling device as in any of the Claims 1 to 7 in which the two end members are held at a fixed longitudinal distance from each other by means of traversing the device.

9. A shock absorbing and coupling device as in Claim 8 in which the end members have projecting flanges or the like adapted to be severally secured by bolts to like flanges or spiders on the ends of the aligned shafts respectively.

Dated this 31st day of March, 1922.

For the Applicant,
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Chartered Patent Agents,
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W.C. 2, London.

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Fig. 1.

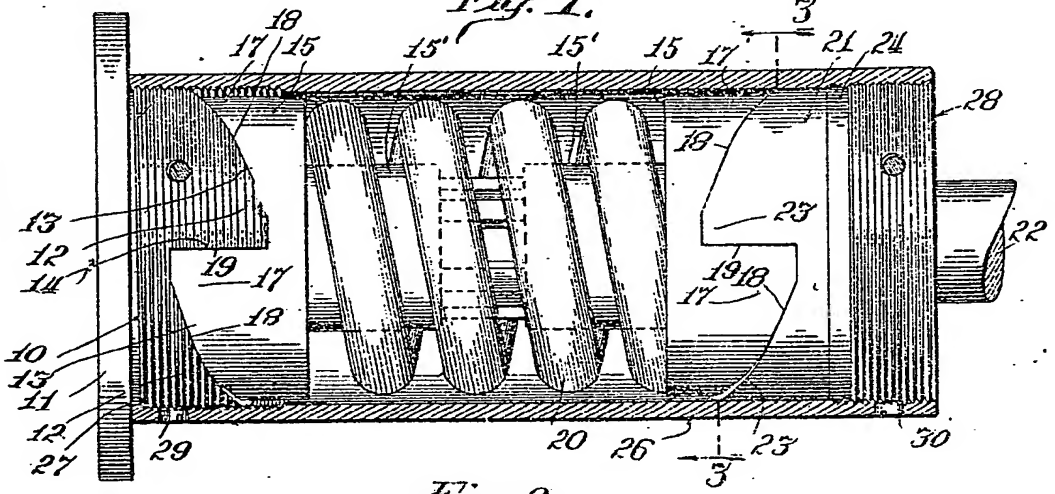

Fig. 2.

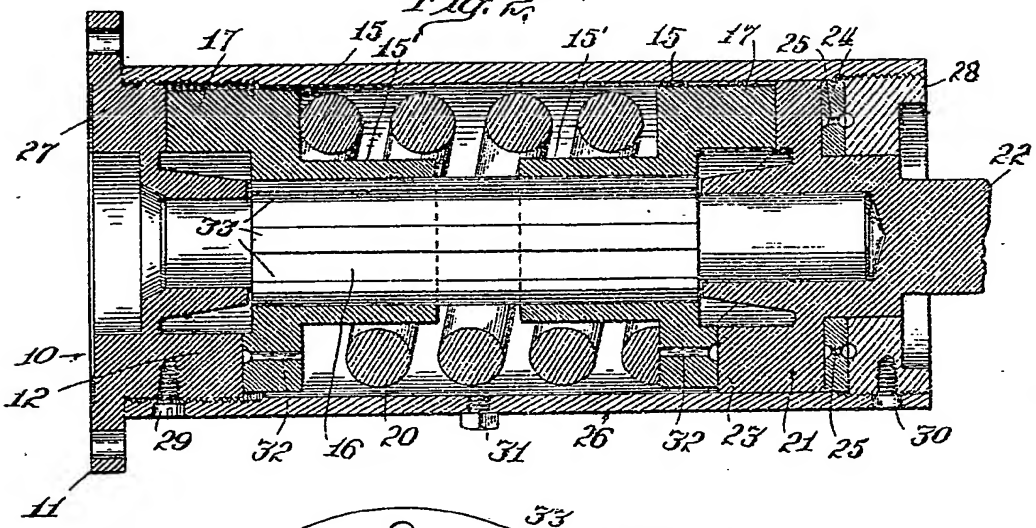

Fig. 3.

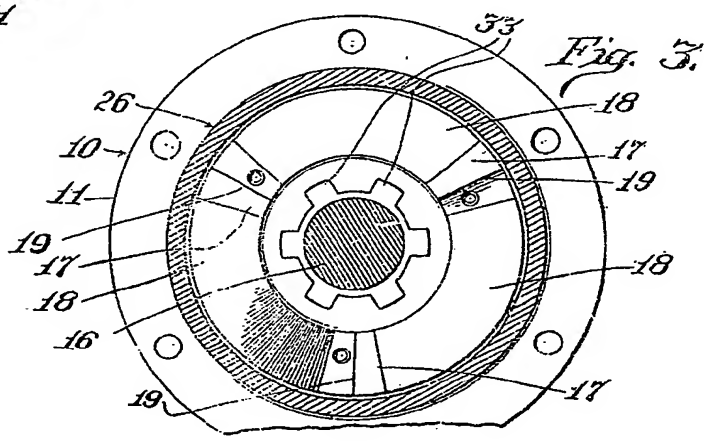

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Fig. 4.

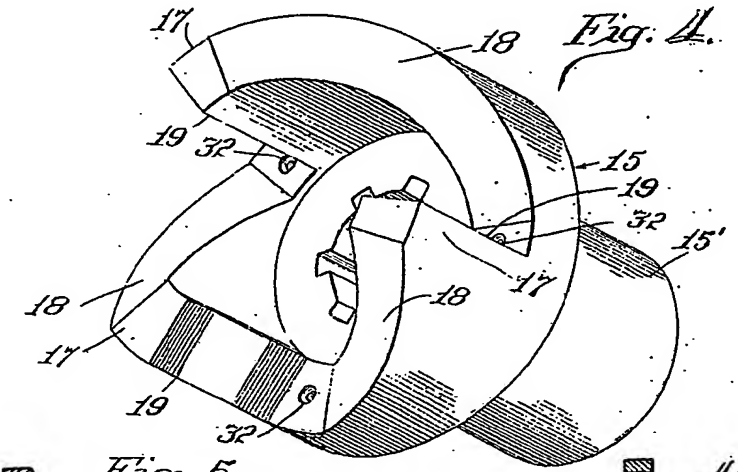


Fig. 5.

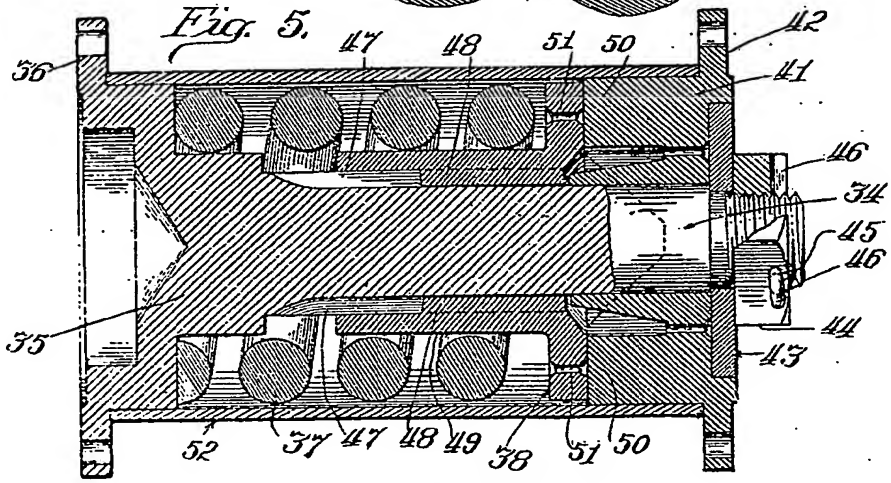
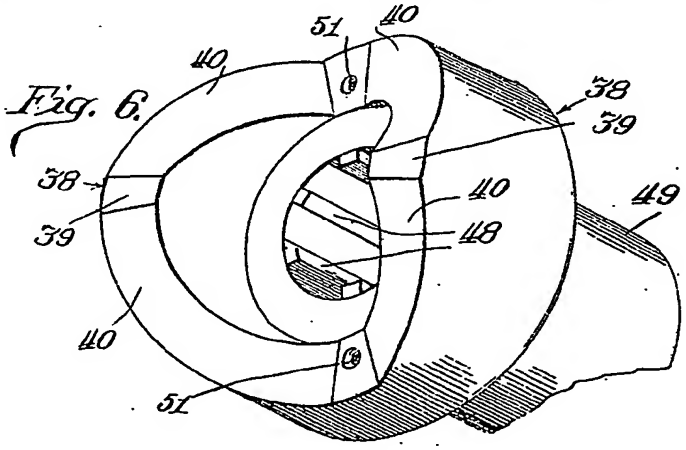


Fig. 6.



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203,010 COMPLETE SPECIFICATION

2 SHEETS

SHEET 1

SHEET 2

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Fig. 1.

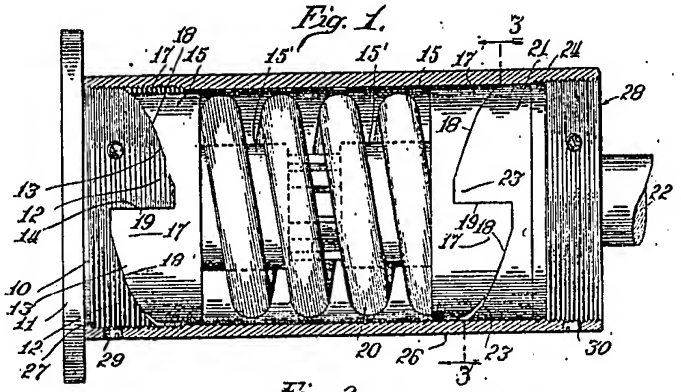


Fig. 2.

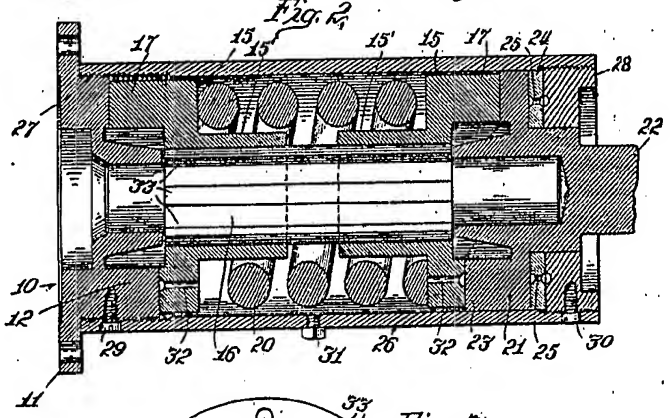


Fig. 3.

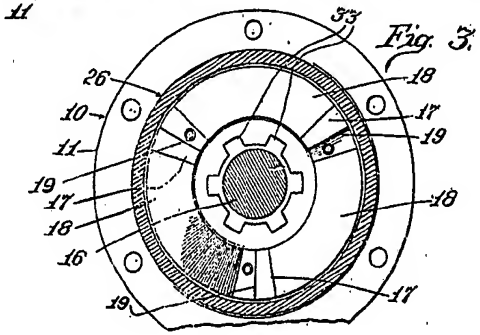


Fig. 4.

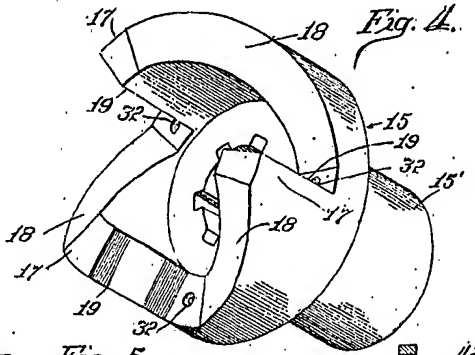


Fig. 5.

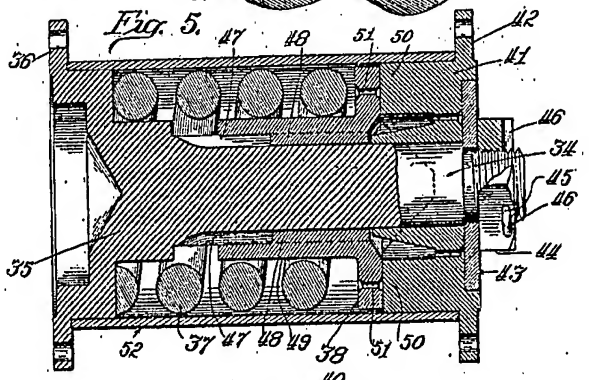
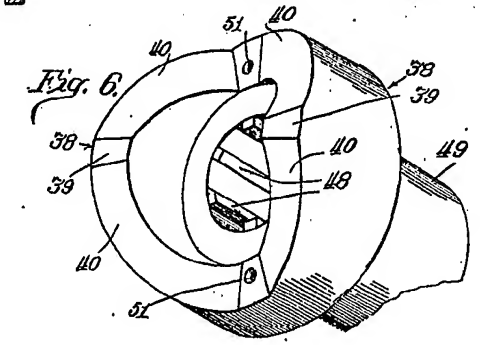


Fig. 6.



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